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INFORMATION ON SOYBEAN MILK:

Soybean milk, a white or creamy emulsion, resembles cows' milk in appearance and consistency. Its specific gravity, chemical composition and food value vary greatly depending upon the method of preparation, the composition of the beans, the amount of water used, and upon the degree of concentration to which the milk has been subjected.

On the average, a well prepared soybean milk contains somewhat more water than the average cows' milk, but less of the other common food constituents, -- fat, minerals, protein and carbohydrates. Soybean milk is also somewhat poorer in vitamin A but richer in vitamin B (E. Tso). From the standpoint of nutritional and biological value, soybean milk compares favorably with cows' milk. Soybean milk to which sugar and minerals have been added is considered adequate when fed to children (Rittinger and Dembo).

Soybean milk is free from tubercular infection and can be produced with little or no contamination. It is a purely vegetable milk and is very cheap to prepare, (Horvath).

The average compositions of soybean-and cows'-milk are approximately as follows:

	Soybean Milk	Cows' Milk
Water	92.00	87.00
Ash	.50	.70
Fat	1.60	3.40
Protein	3.15	4.00
Carbohydrates (by difference)	2.75	4.90

The boiling point of soybean milk is about 101.5 ° C. On boiling, soybean milk tends to froth. As in the case of cows' milk, a creamy pellicle is formed on heating. Like cows' milk also, soybean milk becomes sour and curdled on standing for some time at room temperature. The addition of salts of calcium and magnesium or of organic acids results in the formation of a precipitate or coagulum. A few drops of a culture of lactic acid bacteria will inhibit the putrefaction of soybean milk. Soybean milk supplemented with lactose and inoculated with a culture of yoghourt bacteria coagulates at 40° C in 4 hours and gives a curd-like acid mass (Horvath).

In general, soybean milk can be made from (a) the beans, and (b) the meal or flour.

(A) Soybean milk prepared from the beans:

(a) Use preferably a yellow bean, rich in protein. The beans are washed, then soaked in water from 10 hours in summer to 24 hours in winter, changing the water once or twice. The soaked beans are then crushed by means of a burr mill, a small amount of water being allowed to trickle over the beans during the grinding. The use of too much water makes it difficult to grind the beans sufficiently fine. Add 2 to 3 times the volume of water to the dense milky liquid and let stand for a while to permit the proteolytic enzymes to increase the solubility of the proteins. The milky mass is then boiled until it foams, maintaining simmering heat for 1/2 hour or until the proper concentration has been reached. The liquid is stirred occasionally and a few drops of shell-ash mixed with seed oil are added to the boiling mass to prevent excessive foaming. The liquid mass when filtered through a cotton bag leaves a filtrate which is soybean milk, (Horvath).

(b) Soak the dried beans (preferably the yellow seeded varieties) for a few hours; crush them in a stone mill and boil the mass thus obtained for about 30 minutes in the proportion of 3 parts of water to 1 part of the mass. The mass when passed through a sieve or cloth strainer is soybean milk (W. J. Morse).

(c) Wash the beans thoroughly; soak them in plenty of water for 12 hours, changing the water frequently; grind the soaked beans in a stone mill, adding small amounts of water while grinding. (The total amount of water subsequently added is from 3 to 5 times that of the beans). The thin paste-like fluid is boiled 1/2 hour and then strained through a cheese cloth. A small amount of vanilla extract or other flavoring may be added in order to mask the characteristic odor and flavor of the milk. (Maria Y Orosa).

(d) The ordinary Japanese method for making soybean milk or Toniu is as follows: Soak the beans in water 12 hours at room temperature, changing the water frequently. Grind the beans to a fine smooth paste, perferably in a stone mill, adding water to the mass during the grinding process to the amount of three times the bulk of the beans. Boil this mass to foaming for 1 hour. Strain through cheese cloth. (Arao Itano).

Other variations in the method for making soybean milk follow:

Jethro Kloss recommends the following process: Soak soybeans overnight. Wash several times with fresh water. Cover the beans with water and bring just to a boil. Pour off the water. Grind the beans; leach with 4 times as much cold water as the weight of the beans, press the pulp through cheesecloth, leach again with the same amount of water and again pass through cheesecloth. Boil the milk thus obtained to the desired concentration.

Sadikov, Franzusowa and Chalelzkaja recommend the following:

Wash the beans and soak them for 12 hours at 18° C (65° F). Grind, emulsify with water and pass through a sieve. Shake the milk with refined fat keeping the mixture cold. The fat is not absorbed by the milk, but it removes the unpleasant taste. Skim off the fat layer, and shake the milk with a fresh portion of fat at 140° F., whereby a portion of the fat is emulsified. (Chem. Zent., volume II, page 1985, 1932.)

Muggia and Gasca give the following: To prepare 100 liters of soybean milk, wash 15 to 16 kg. of soybeans; steep in tepid water 12 to 24 hours; grind in stone mill adding a little water during the grinding. Boil 15 minutes, strain through cheesecloth, and add a small amount of cows' milk to improve the flavor.

Bogatskii and his associates succeed in deodorizing soybean milk by passing hot air through it. The milk is sterilized at 115 to 120° C for 15 to 20 minutes.

Fr. Gössel, for the preparation of soybean milk, utilizes small amount of di-sodium phosphate, lactose, sodium-bicarbonate, sesame oil and salt. (Ger. Pat. 268,536 and 289,929.)

E. M. Castagnol's method is as follows: Soak soybeans 12 hours. Grind in a stone mill, wetting the beans during grinding with 25% as much water as the weight of beans. Add 2-1/2 times as much water as weight of beans. Separate the milk by passing the liquid mass through a centrifuge machine. Boil to desired concentration.

Wash the beans and soak them overnight. Remove the skins, grind the beans fine, place in cheesecloth bag in a bowl of luke-warm water, using 3 quarts of water to each pound of dry beans. Work with the hands for 5 to 10 minutes, wring the bag until dry. Boil the liquid for 1/2 hour stirring frequently. Add sugar and salt to taste. Keep in a cool place (Consumers' Guide, U. S. D. A., April 20, 1936, page 7).

(B) Soybean milk prepared from meal or flour:

The Japanese method for making Toniu or soybean milk from soybean meal of flour is as follows: Add water to the amount of 5 times the bulk of soybean meal. Let stand 12 hours at room temperature. Boil to foaming-point 1 hour. Strain through fine cheesecloth. The white opaque liquid is soybean milk(Arao Itano).

Itano's own method is: Add water to the amount of 5 times the bulk of bean meal. Inoculate with B. coli and B. lacto aerogenes, as used in salt rising bread. Let stand 16 hours at room temperature. Boil to foaming 1 hour. Filter through fine cheesecloth; add 1/2 teaspoonful salt per quart of liquid; Adding 5% milk sugar (lactose) improves the taste. Thus prepared the occurrence of flatulency in the alimentary tract is reduced.

Soak soybean meal 8 hours. Pass steam at 100° C to deodorize. Stir up with water to an emulsion (1 kg. soybean meal yields 5 liters emulsion.) Press or squeeze through cloth. Boil the milk 5 minutes for every 5 liters of liquid. Add 0.25% salt, 0.5% glucost, and 2% soybean oil beside .02% vanillin or .2% bitter-almond oil. Mix thoroughly and boil (Horowitz-Ulasova, Oberhard, Gutermann).

Grind coarsely soybeans to remove hulls. Soak overnight in 8 to 10 times its weight of water. Grind in burr stone mill or food chopper to a thin paste. Pass through cheesecloth. One pound of soybeans will yield approximately 3 quarts of the milk. Boil 30 minutes. This milk contains 4.4% protein, 1.8% fat, 0.41% ash, 0.018% calcium, .057% phosphorus, and 1.5% carbohydrates. (W. J. Morse, B. P. I., U. S. D. A.)

Condensed soybean milk:

(1) A concentrated soybean milk can be made by evaporating in a vacuum the well mixed ordinary soybean milk. The condensed milk is somewhat less white than the corresponding product of cows' milk, but it resembles the latter in its nutritional value and in its keeping quality. The peculiar odor of condensed soybean milk can be largely corrected by adding 1 drop of essence of cumarine per gallon of milk. The concentrated product can be subsequently diluted with water without the formation of lumps or separation of fat. (Pure Products, 1912).

(2) To 10 liters (2.6 gallons) of soybean milk add 10 grams di-potassium phosphate and 1500 grams cane sugar. Concentrate in a vacuum to a thick liquid. (Mass. Exp. Sta. Bull. 182).

Soybean milk powder:

The method employed in preparing soybean milk powder is similar to that used in the preparation of powdered cows' milk.

(1) Pour small streams of the milk on the surface of hollow steel rolls revolving in opposite directions and against each other. The rolls are heated inside by live steam and so adjusted as to allow a thin film of the milk to pass between them. The stream of milk dries instantly upon coming in contact with the rolls and the dry milk coating thus formed is scraped off by sharp knives. Some manufacturers first concentrate the thin soybean milk before passing it between the rolls (Maria Y Orosa).

(2) The more modern method of preparing soybean milk powder is by the spray process. The milk is first concentrated in a vacuum pan and passed to sanitary tanks which are connected with the spray apparatus. The concentrated milk is then sprayed or "atomized" into a dry heated chamber, whereby the moisture is withdrawn from the milk, leaving behind a dry powder. This chamber is supplied continuously with fresh, heated dry air. The atomized milk dries instantly in the form of flour and falls to the floor of the chamber. The powdered milk

thus produced is collected and packed in moisture-proof cans (Maria Y Orosa).

(3) To each liter of ordinary soybean milk add 50 grams cane sugar, 30 grams egg yolk, 1 gram table salt, 2.5 grams calcium lactate and spray this mixture at 55° C. This powder contains 3.62% moisture, 28.6% protein, 16.4% fat, 3.98% ash, 47.2% carbohydrates, 0.31% calcium, and 0.47% phosphorus (Eric Reid).

According to Li Yu Ying (Le Soya), soybean powder contains 7% moisture, 46% protein, 27.6% fat, 6% ash, and 13.4% nitrogen free extract.

Ke Chung Chang and E. Tso report the following as the composition of soybean powder: 5.6% moisture, 28.4% protein, 4.5% fat, 4.5% ash, 0.8% fiber, and 58.9% carbohydrates.

These wide variations in the composition of the powder are due to the different methods used in the preparation of the soybean milk and the variety and composition of the beans.

Prepared by:

J. A. LeClerc,
Food Research Unit,
Agr. Chem. Research Division

BUREAU OF AGRICULTURAL CHEMISTRY
AND ENGINEERING
U. S. Dept. Agriculture.

Attached:
Partial list of references
on soybean milk.